Decision Rationale

Total Maximum Daily Load Analysis for the Murderkill River Watershed

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) decision rationale for approving the "Technical Analysis for the Amendment of the 2001 Murderkill River Total Maximum Daily Loads (TMDLs)" submitted for EPA review by the Delaware Department of Natural Resources and Environmental Control (DNREC) on May 24, 2005. These TMDLs amend the original TMDL for nine waterbody segments (five stream segments and four ponds) listed on the State of Delaware's Clean Water Act (CWA) 1996 and 1998 Section 303(d) lists for dissolved oxygen (DO) and nutrients. EPA's decision rationale is based on the updated TMDLs and other information provided in the documents submitted by DNREC to determine if the updated TMDLs meet the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDLs are designed to implement applicable water quality standards.
2) The TMDLs include a total allowable load as well as individual waste load allocations (WLAs) and load allocations (LAs).
3) The TMDLs consider the impacts of background pollutant contributions.
4) The TMDLs consider critical environmental conditions.
5) The TMDLs consider seasonal environmental variations.
6) The TMDLs include a margin of safety (MOS).
7) There is reasonable assurance that the TMDLs can be met.
8) The TMDLs have been subject to public participation.

Section 303(d) of the CWA, as amended by the Water Quality Act of 1987, requires states to identify water quality limited waters within their boundaries, to prioritize them and to develop TMDLs for pollutants of concern. Water quality limited waters include those waters that secondary treatment for Publicly Owned Treatment Works and Best Practicable Control Technology Currently Available for other point sources are not stringent enough to meet water quality standards (WQS).

DNREC identified the following segments of the Murderkill River and its tributaries and ponds as water quality limited waters because of high nutrients and/or low DO and placed them on the State's 1996 and 1998 303(d) lists: 1) Lower Murderkill River; 2) Mid Murderkill River; 3) Upper Murderkill River; 4) Spring Creek; 5) Browns Branch; 6) McGinnis Pond; 7) Courseys Pond; 8) Killens Pond; and 9) McCauley Pond.

EPA was sued (American Littoral Society and Sierra Club v. EPA) regarding EPA's oversight of the TMDL program in Delaware. A court-approved Consent Decree (Civil Action No. 96-591 (SLR) (D.De) - August 9, 1997) required that TMDLs for segments in the Murderkill River Watershed listed on the 1996 Section 303(d) list for DO and nutrients be established by Delaware on or before December 31, 2001. The TMDLs and WLAs developed in 2001 were challenged by Kent County the operator of a wastewater treatment in the watershed.

Kent County appealed DNREC's TMDL regulation to the Environmental Appeals Board and to Superior Court. On December 20, 2001, DNREC and Kent County reached an agreement whereby DNREC agreed to re-examine certain aspects of its model and collect additional water quality data, and to stay the regulation insofar as it imposed a new WLA upon Kent County's facility.[1] As a result of this work, it was determined that modifications to the TMDLs and WLAs were needed. Information on the Murderkill River segments covered by these TMDLs is found in Table 1.

Table 1 - Murderkill River Watershed Segments Requiring DO/Nutrient TMDLs in 2001

Waterbody ID (Total Size)	Segment	Description	Size Affected	Pollutant(s) and/or Stressors	Probable Source(s)
DE220-001 (27.5 miles)	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.6 miles	Nutrients and DO	PS, NPS
DE220-002 (36.5 miles)	Spring Creek	From the headwaters to the confluence with Murderkill River, excluding McGinnis Pond	15.8 miles	Nutrients and DO	PS, NPS
DE220-003 (16.2 miles)	Mid Murderkill River	From McCauley and Courseys Pond to the confluence with Spring Creek	9.2 miles	Nutrients	PS, NPS
DE220-004 (24.1 miles)	Browns Branch*	From the headwaters adjacent to Harrington to the confluence with McCauley Pond	8.8 miles	DO and Nutrients	NPS
DE220-005 (21.7 miles)	Upper Murderkill River	From the headwaters to the confluence with Courseys Pond, excluding Killens and Courseys Ponds	7.4 miles	Nutrients	NPS
DE220-L01 (31.3 acres)	McGinnis Pond*	Pond east of Viola	31.3 acres	Nutrients	NPS
DE220-L03 (58.1 acres)	Courseys Pond	Pond southwest of Frederica	58.1 acres	Nutrients	NPS
DE220-L04		Pond southwest of			

[1]DNREC 2005. Final Regulation Amending Total Maximum Daily Loads for the Murderkill River Watershed.

(75.1 acres)	Killens Pond	Felton	75.1 acres	Nutrients	NPS
DE220-L05 (49.0 acres)	McCauley Pond	Pond northeast of Harrington	49.0 acres	Nutrients	NPS

* First listed on 1998 303(d) list.

The Murderkill River Watershed TMDLs are based on an assessment of the water quality conditions of the Murderkill River and its tributaries and ponds during model design conditions under various levels of point and nonpoint source loads. A calibrated and verified hydrodynamic and water quality model of the Murderkill River and its tributaries and ponds was used as an assessment tool. The original Murderkill River Model was developed using extensive hydrologic and water quality data collected from 1996 through 1999. The updated model uses the same water quality data and incorporated updated hydrologic data collected from an acoustic doppler current profiler (ACDP) in September 2002.

Considering the results of the water quality assessment, DNREC determined that in order to meet Delaware's WQS in the Murderkill River Watershed, the point and nonpoint source loads of nutrients (nitrogen and phosphorus) and oxygen consuming compounds (CBOD5) within the watershed should be reduced according to the levels specified in Table 4.2 found in Chapter 4 of the *Technical Analysis for Amendment of the 2001 Murderkill River TMDLs* and below. The updated Murderkill River TMDLs include WLAs for point source discharges and a LA for nonpoint sources that when implemented will achieve WQS. The MOS for the Murderkill River TMDLs is implicit as the result of consideration of conservative assumptions made during the TMDL analysis. DNREC has made a determination that the amended Murderkill TMDLs will allow WQS to be attained in the 303(d) listed waterbodies in the Murderkill River Watershed.

II. Background Information

The Murderkill River Watershed has a drainage area of 106 square miles and is located in the southeastern portion of Kent County, Delaware. The Murderkill River is the main branch of the system and flows eastward approximately 20 miles from its headwaters west of Felton to its confluence with Delaware Bay at Bowers Beach. The lower portion of the Murderkill River (from its mouth at Delaware Bay to just upstream of Rt. 113 Bridge at Frederica) is tidally influenced. Several free flowing tributaries are in the watershed including Browns Branch, Double Run, and Hudson Branch. In addition, a number of lakes and ponds are found within the watershed including McCauley Pond on the Browns Branch, Killens Pond and Courseys Pond on the Murderkill River, McGinnis Pond on the Hudson Branch, and Andrews Lake on the Spring Creek Branch.

Landuse /Land Cover

The last survey of landuse/land cover for the Murderkill River Watershed was conducted in 2002. According to this survey, the breakdown of various landuse/land cover activities within the watershed include agriculture (55%), wooded/forest (17%), wetlands (9%), urban areas

(14%), and water (2%).

Significant Environmental Features

The Federally threatened swamp pink (a perennial wildflower) and the Federally threatened bald eagle have been found in the Murderkill River Watershed. The Murderkill River TMDLs will not adversely impact the continued existence of these species in the watershed.

Sources of Pollution

Nutrient over enrichment and low DO are environmental problems of significant concern in the Murderkill River watershed. Major sources of pollution causing these problems include point source discharges from wastewater treatment plants (National Pollutant Discharge Elimination System (NPDES) facilities)), surface runoff from agricultural and other land use activities, septic tanks, and groundwater discharges loaded with nutrients, especially nitrogen.

A. Point Source Loads

Discharge of pollutants to the waters of Delaware is regulated through DNREC's administration of the NPDES Permit program. Section 402 of the CWA, as amended by the Water Quality Act of 1987, requires all dischargers to waters of the state to apply and obtain a NPDES Permit prior to initiation of discharge. A NPDES Permit is issued for a five-year period and regulates the quality and quantity of pollutants that can be discharged to the surface waters of the state.

In 2001, there were four municipal wastewater treatment plants discharging in the Murderkill River Watershed. These facilities were:

1) City of Harrington Sewage Treatment Plant (NPDES No. DE 0020036),
2) Kent County Facility (NPDES No. DE 0020338),
3) Canterbury Crossing Mobile Home Park (MHP) (NPDES No. DE 0050075), and
4) Southwood Acres Mobile Home Park (MHP) (NPDES No. DE 0050172).

The Southwood Acres Mobile Home Park no longer discharges to the Murderkill and has been removed from the study. There are now three point source dischargers in the watershed.

Table 2 - Point Sources in the Murderkill River Watershed

Facility Name	NPDES ID	Size	Type	Receiving Stream
City of Harrington STP	DE0020036	Minor	Municipal	Browns Branch

Kent County Facility	DE0020338	Major	Municipal	Tributary to the Murderkill River
Canterbury Crossing MHP	DE0050075	Minor	Municipal	Double Run

As a requirement of a NPDES Permit, all facilities discharging to the waters of the state must monitor their effluent for flow and concentration of pollutants and report them to DNREC using standard formats (Discharge Monitoring Reports (DMRs)). The permitted flow values and inputs from the DMRs during the model calibration and validation period were used to calibrate and validate the Murderkill River Model. Table 3 lists permitted flows and estimated pollutant loads (total nitrogen, total phosphorus, and BOD) for the point source facilities in the Murderkill River Watershed at the time of the 2001 TMDL.

Table 3 - NPDES Permitted Loads from Point Sources

Facility Name	Average Flow (mgd)	Total N (lbs/day)	Total P (lbs/day)	BOD (lbs/day)
City of Harrington STP	0.492	55.0*	2.0	62.0
Kent County Facility	15.0	908.0*	342.0*	2502
Canterbury Crossing MHP	0.05	4.4*	1.5*	6.3
Southwood Acres MHP	0.024	2.2*	0.8*	3.0
Total	**15.566**	**969.6**	**346.3**	**2573.3**

* Estimated based on effluent monitoring data.

B. Nonpoint Source Loads

Surface runoff from agricultural fields and urban areas, as well as seepages from septic tanks and ground water fluxes, are major sources of nonpoint source pollutants (nutrients and oxygen consuming organic matters) to the waters of the Murderkill River and its tributaries and ponds.

The nonpoint source loads to the Murderkill River Model were determined by: 1) dividing the watershed into smaller sub-basins based on a Digital Elevation Model analysis; 2) calculating runoff flows for each sub-basin based on the flow at the United States Geological Survey (USGS) stream gauging station 01484000 on the Murderkill River at Route 13 Bridge, Felton, and the drainage ratio of the ungauged sub-basin to the USGS gauging station; and 3) assigning a runoff concentration to each sub-basin based on land use characteristics. Based on the above analysis, the nonpoint source nutrient loads for the entire Murderkill River Watershed during Model calibration period is listed in Table 4 these values were used in both the 2001 and

2005 TMDLs.

Table 4 - Assessment of Nonpoint Source Loads

	Total Nitrogen (lbs/day)	Total Phosphorus (lbs/day)
Nonpoint Source Load	676	142

III. Discussion of Regulatory Conditions

Federal regulations at 40 CFR Section 130 require that TMDLs must meet eight regulatory conditions. EPA finds sufficient information has been provided to meet all the eight basic regulatory requirements for establishing DO and nutrient TMDLs for the Murderkill River Watershed.

1. The TMDLs are designed to implement applicable water quality standards.

The amended TMDLs are the result of various load reduction analyses, which were conducted using the updated Murderkill River Water Analysis Simulation Program (WASP) Model (see discussion below) as a predictive tool. When the amended TMDLs are implemented, all segments of the Murderkill River system will achieve applicable WQS for DO. The guidance levels for total nitrogen and total phosphorus will be attained in all segments of the watershed with the exception of a single headwater segment.

Section 10 of the State of Delaware Surface WQS, as amended, August 11, 1999, specifies the following designated uses for the waters of the Murderkill River Watershed: Primary Contact Recreation, Secondary Contact Recreation, Fish, Aquatic Life, and Wildlife, and Industrial Water Supply. In addition, freshwater segments of the Murderkill River are designated for Agricultural Water Supply. The WQS applicable to the Murderkill River Watershed based on the designated uses and employed in the TMDL analysis are shown in Table 5.

DNREC does not have numeric criteria for Total Nitrogen or Total Phosphorus. As an interpretation of the narrative statement included in the DNREC WQS on nutrients, DNREC uses threshold values of 1.0 -3.0 mg/l for Total Nitrogen and 0.1-0.2 mg/l for Total Phosphorus to eliminate over enrichment in surface waters. This target values are based on literature values and best professional judgment. The results of model analysis and scenario runs for the recommended TMDLs indicate that the DO WQS are met in the watershed and the nutrient threshold levels are met in all segments of the Murderkill River system except a single headwater segment (segment 47) with little or no downstream detrimental impacts. Segment 47 is a free-flowing segment; the water movement would likely prevent any nutrient overenrichment and algal blooms from occurring in this area. EPA finds DNREC's

interpretation of its WQS protective and reasonable in using the recommended threshold levels for Total Nitrogen and Total Phosphorus. Therefore, EPA finds that the proposed TMDLs meet applicable WQS and endpoints.

Table 5 - TMDL Endpoints

Numeric Criteria		
Parameter	**WQS Standard**	**Comment**
Dissolved Oxygen	1) 5.5 mg/l daily average (from June - September) for fresh waters. 2) 5.0 mg/l daily average (from June - September) for marine waters. 3) 4.0 mg/l minimum at any time for both fresh and marine waters.	Established by Delaware Water Quality Standards (August 11, 1999) Fresh waters are defined as those having a salinity of less than 5 parts per thousand. Marine waters have salinity equal to or greater than 5 parts per thousand.
Narrative Criteria		
Parameter	**Target Value**	**Comment**
Total Nitrogen	1.0 to 3.0 mg/l	Policy statement - threshold level established to eliminate nutrient over enriched waters.
Total Phosphorus	0.1 to 0.2 mg/l	Policy statement - threshold level established to eliminate nutrient over enriched waters.

To evaluate the Murderkill River and to develop a scientifically reliable assessment and management tool for evaluating and quantifying the impact of various sources of pollution on water quality in the Murderkill River Watershed, DNREC developed a comprehensive hydrodynamic and water quality model for the Murderkill River. A three-year, intensive basin-wide hydrologic and water quality monitoring effort preceded development of the model for the 2001 TMDL. An environmental modeling contractor (HydroQual, Inc.) was selected to develop, calibrate and validate a hydrodynamic and water quality model for the Murderkill River in 2001. EPA's WASP modeling framework was selected as the appropriate modeling tool for the 2001 study. The general purpose WASP model was developed by EPA and has been widely used in many riverine and estuarine systems in the United States and worldwide. The WASP5 Model of

the Murderkill River consists of two submodels: 1) hydrodynamic model (DYNHYD5), and 2) water quality model (EUTRO5). The Murderkill River WASP Model was calibrated and validated using water quality and hydrodynamic data collected during 1996-1999.

The hydrologic portion of the 2001 model was updated in the amended TMDLs. Several aspects of the hydrologic model including stream geometry, wind speed and light extinction were updated. Stream geometry is the system of geometry that describes the shape of the stream channel and reflects the volume of water which the stream can accommodate. The volume of water has a direct impact on the amount of a pollutant a water can assimilate and still achieve designated water uses. In response to concerns regarding a possible underestimation of the tidal currents in the Lower Murderkill River TMDL, DNREC conducted a survey of the Murderkill River to measure the stream geometry and reevaluate the measurements contained in the 2001 Murderkill TMDLs. The survey measured the lower Murderkill River channel during spring and neap tides through the use of an ADCP to evaluate the accuracy of the original 2001 model's stream geometry and tidal flow. DNREC took ADCP transects at spring tides (September 21, 2002) as well as neap tides (September 29, 2002).[2] The ADCP was mounted on a boat which transected the channel hourly at two sections of the estuary, Bowers Beach and Frederica. Based on this survey, DNREC could calculate the volume of flow moving through the lower Murderkill and then compare those calculations with those used for the 2001 TMDL. The ADCP transect output provided the depth of the segment and the amount and rate of water flowing through that segment. This information allowed DNREC to more accurately determine the total discharge from each section.

[2] Spring tides are higher than average tides that occur when the sun aligns with the earth and moon to increase gravitation pull in the direction of the moon. Neap tides are lower than average tides that occur when the sun and moon form a 90 degree angles with the earth, so that the sun's gravitational force draws off some of the water of both tidal bulges.

By combining the new information on water volume (the flows from each section) with data on tidal height, DNREC reevaluated and recalculated the surface area of each segment. The report prepared by the University of Delaware's College of Marine Studies cautioned the use of points within 30 minutes of either high or low water.[3] Based on this approach the 2005 TMDL calculates the total tidal area as 1.28E+06 square meters for the spring tide area and 1.06E+06 square meters for the neap tide area. As described below larger volumes of water have a greater capacity to handle oxygen consumptive (demanding) pollutants than smaller bodies of water, if all other factors remain equal (including the assumption that the larger volumes of water do not contribute net additions of overall pollutant loading). Based on the new information and model assumptions supplied by DNREC, the increased size for the lower Murderkill increases the amount of nutrient pollutants the water may be able to receive and still achieve and maintain the applicable DO criteria and aquatic life uses.

Another important variable to this model is the wind speed. Wind aerates the system, providing mixing between the surface waters and the air to which introduces additional oxygen into the estuary. As the wind speed increases, there is more turbulence on the water surface and waters are able to mix to a deeper depth. In general, as wind speed increases, a greater depth of water is re-aerated by oxygen through the air water interface. In the 2005 TMDL, DNREC adjusted the wind speed from 0 to 1.5 meters per second. The 2001 TMDL used a zero wind speed which is very conservative but not consistent with actual conditions. While the specific reason for this change in the 2005 TMDL was not provided in the reports. EPA conducted a cursory review and found that the average annual wind speed for a fifty-three year data set concluding in 2001 for Wilmington, Delaware was 9.0 miles per hour or roughly 4.0 meters per second. This data was extracted from the National Oceanic and Atmospheric Agencies data set and obtained at www.berner.com/new/energy-windspeed.htm. DNREC also adjusted the variables for sediment oxygen demand (SOD) and light extinction rates in various segments of the 2005 TMDL model. Light extinction impacts the areas in which primary production can occur as photosynthesis requires light and if the light does not penetrate as deep in the water column primary production occurs in less of an area. SOD is the consumption of oxygen in association with the breakdown of nutrients in benthic layers. The modifications to the SOD were based on a better calibration of the simulated to observed data.

2. The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.

In evaluating necessary treatment and pollutant reduction needs for the Murderkill River Watershed, DNREC conducted model runs on numerous TMDL scenarios. All of the TMDL scenarios included WLAs for the point source dischargers in the watershed and LAs for nonpoint sources. The scenario used to develop the amended TMDLs is provided below.

A. Point Source Loads

[3]Wong, Kuo. 2003. An Analysis of the Data Derived from an Acoustic Current Profile Survey of the Tidal Murderkill River, Kent County Delaware.

For the selected scenario, the following point source loads were considered:

1. City of Harrington STP Facility (for a seasonal flow of 0.492 mgd). For this facility it was assumed that wastewater is treated to achieve the following effluent limits:

- CBOD5 = 8 mg/l
- Total nitrogen = 6.0 mg/l
- Total phosphorus = 0.5 mg/l
- Dissolved oxygen = 7 mg/l

2. Kent County Facility (for a flow of 15 million gallons per day). For this facility it was assumed that wastewater is treated to achieve the following effluent limits:

- CBOD5 = 8 mg/l
- Total nitrogen = 6.0 mg/
- Total phosphorus = 0.5 mg/
- Dissolved oxygen = 7.0 mg/l

3. Canterbury Crossing MHP (for a flow of 0.05 million gallons per day). For this facility it was assumed that wastewater is treated to achieve the following effluent limits:

- The CBOD5 load from this facility is capped at its current permitted load
- The total nitrogen load for the facility is capped at its current level
- Total phosphorus = 0.5 mg/l
- Dissolved oxygen = 7.0 mg/l

B. Nonpoint Source Loads

For the selected scenario, it was assumed that the runoff concentration values for nonpoint source nutrients in the watershed is reduced by 30% for total nitrogen and 50% for total phosphorus.

The results of the selected TMDL scenario is summarized in Table 6.

Table 6- TMDLs for the Murderkill River Watershed

Sum of Individual Waste Load Allocations (WLA)				
Point Source	**Flow (mgd)**	**Total N**	**Total P**	**CBOD5***
		lbs/day	**lbs/day**	**lbs/day**
City of Harrington	0.750	140	0.75	37.5

Kent Co. Facility	15.0	751.0	62.5	1001
Canterbury Crossing MHP	0.05	4.3	0.2	9.6
WLA Subtotal	**-**	**1455.0**	**159.45**	**1048.1**
Load Allocation for Nonpoint Sources				
-	**-**	**560.0**	**96.0**	**-**
Total TMDL for the Murderkill River Watershed				
TMDL Total	**-**	**2015.0**	**255.45**	**1048.1**

*Reduction percentage based on equivalent BOD5 permit values.

The TMDL increases the daily nitrogen and decreases the daily phosphorous loads from point sources when compared to existing conditions in 1998. However, there is a reduction in the nitrogen load when comparing the TMDL load to the estimated 2001 wasteloads as identified in Table 3. EPA calculated the 1998 nitrogen and phosphorous loads to be 1,470 and 415 pounds/day respectively. The nonpoint source LA was calculated by applying the selected TMDL scenario reduction percentages of 30% for total nitrogen and 50% for total phosphorus in the runoff concentration values for each sub-basin contained in the Murderkill TMDL Model. The reduced runoff concentration values were used in the calculations based on daily stream flow to derive resulting pound/day values. The sub-basin amounts for each nutrient were then totaled to provide the aggregate watershed LA for total nitrogen and phosphorus. The aggregate net reductions achieved (estimated nonpoint source load vs. LA) on a pounds/day basis were 17% for total nitrogen and 33% for total phosphorus.

3. The TMDLs consider the impacts of background pollutant contributions.

The Murderkill River TMDLs were established using a calibrated and verified hydrodynamic and water quality model of the Murderkill River. The Murderkill River Model was developed using an extensive water quality and hydrologic database. The water quality and hydrologic database included headwater streams representing background conditions for nutrients and other pollutants. Therefore, it is concluded that the impact of background pollutants are considered in the Murderkill River TMDLs.

4. The TMDLs consider critical environmental conditions.

The Murderkill River TMDLs were established based on an evaluation of the water quality condition of the river and its tributaries and ponds during the month of July 1997. The month of July 1997 was considered as the design condition for assessing the impact of nutrients and CBOD on water quality condition of the river. July 1997 was a relatively dry month with stream flows well below their long-term annual average flow of 18.54 cubic feet per second (cfs). In fact, the average flow during the month of July 1997 at the USGS gauging station

01484000 on the Murderkill River at Felton was 3.37 cfs with the minimum flow of 2.4 cfs. These flow rates are close to the 7Q10 (7-day average flow occurring once in 10 years) flow at this site which is 1.8 cfs. Also, the ambient air and water temperatures during the month of July 1997 were relatively high, contributing to the critical environmental conditions. The results of the water quality modeling analysis have shown that considering the above design conditions, state WQS and guidelines are still met within the Murderkill River system including its tributaries and ponds. Therefore, it was concluded that consideration of critical environmental conditions was incorporated in the Murderkill River TMDL analysis.

5. The TMDLs consider seasonal environmental variations.

An updated hydrodynamic and water quality model of the Murderkill River and its tributaries and ponds was used to establish the proposed amended TMDLs. The Murderkill River Model was calibrated for the period of 6/6/97 through 1/12/98 and was validated for the period of 3/6/98 through 9/30/98. The above calibration and validation periods included different seasons with varying environmental conditions. Therefore, seasonal variations were adequately considered in establishing the Murderkill River TMDLs.

6. The TMDLs include a margin of safety.

EPA's technical guidance allows consideration of a MOS as implicit or as explicit. An implicit margin of safety is when conservative assumptions are considered for model development and TMDL establishment. An explicit MOS is when a specified percentage of assimilative capacity is kept unassigned to account for uncertainties, lack of sufficient data, or future growth.

An implicit margin of safety has been considered for establishing the proposed amended Murderkill River TMDLs. The updated Murderkill River Model was calibrated using conservative assumptions regarding reaction rates, pollutant loads, and other environmental conditions. Consideration of these conservative assumptions contributes to the implicit MOS. In addition, the TMDLs were developed under a scenario where several critical conditions such as low stream flows, high temperature, and maximum point source discharges occur simultaneously. Since the possibility of occurrence of all these critical conditions at the same time is rare, the above consideration contributes to the implicit MOS. Therefore, EPA concludes that DNREC's use of an implicit MOS is adequate and protective for this TMDL analysis.

7. There is reasonable assurance that the TMDLs can be met.

The proposed Murderkill River TMDLs consider the reduction of nutrients and CBOD from point and nonpoint sources. The load reductions, WLAs and LAs recommended by the TMDLs are technically feasible. DNREC administers the NPDES Permit program under delegation from EPA and as affected point source discharges submit applications for NPDES Permit renewal, DNREC will be able to ensure consistency with the WLAs in Murderkill River TMDLs.

In addition, DNREC has established a Murderkill River Tributary Action Team to assist the Department in developing the pollution control strategy. This Team membership list includes a variety of government, business and public interests. DNREC is planning to finalize and adopt the Murderkill River Pollution Control Strategy within one year of the amended TMDLs' adoption.

8. The TMDLs have been subject to public participation.

EPA policy is that there must be full and meaningful public participation in the TMDL development process. The amended TMDL was presented to the general public during a workshop held on August 12, 2004 and a public hearing on April 7, 2005.